J. Babylon Univ., 10(3) : 481-485. March 2005.

Bacterial Profile of Blood Stream Infections In Children Less Than Three Years Old

Alaa H. Al-Charrakh[1] **Ali M. Al-Muhana**[2]

Zainab H. Al-Saadi[1]

[1] Dept. of Microbiology, Coll. of Medicine, Babylon University, Hilla, Iraq.

[2] Dept. of Microbiology, Coll. of Medicine, Kufa University, Najaf, Iraq.

ABSTRACT

247 blood specimens were collected from prematures, infants, and children (aged from 1 day to 3 years) admitted to the hospital of maternity and pediatrics in Najaf during the period from October to December 1996.

The following bacterial species were recovered: *Klebsiella* spp., *E. coli, Staph aureus, Pseudomonas* spp., *Enterobacter* spp. β. hemolytic streptococci, *St. pyogenes, St. pnenmoniae, Enterococcus. faecalis, viridans St., Alcaligens faecalis, acinetobacter calcoaceticus, Proteus* spp., *and Serratia marcescens.*

The most common etiologic agents of pediatric bacteremia were *Klebsiella* spp. and *E. coli*., together isolated from 68.4% of the blood samples studied.

The resistance of the recovered *Klebsiella* spp. isolates to a number of antimicrobial agents was determined, and a pattern of multiresistance was observed which may explain the prevalence of these isolates in pediatric bacteremia in the area of the study.

Key words: Pediatric bacteremia, Bacterial Profile, Klebsiella

INTRODUCTION

Despite considerable progress in hygiene, antimicrobial therapy, and supportive treatment, blood stream infections remain important causes of morbidity and mortality which, may reaches to 20%-30% in the United States [1].

Microbiologic culturing of blood is the only available means for diagnosis of these infections and allows for successful recovery of bacteria in 99% in patients with bacteremia of septicemia [2].

An American review covering a 50-years period has show major changes in the etiology of neonatal septicemia [3]. Group A streptococci, coliform organisms, and *Staph. aureus* have dominated during different periods. In the 1980s group B streptococci emerged and increased rapidly [4-8].

Ling and her colleagues described the distribution of blood culture isolates at hospital in Hong Kong during 1980-1981 [9].

In a five year prospective study of blood-culture positive septicemia in Hong Kong, 16% of blood stream infections were occurred in children less than 15 years old [10].

The purpose of this study was to determine the commonest organisms causing bacteremia in children less than 3-years in Najaf, Iraq.

MATERIALS AND METHODS

Blood Samples

In this study 247 blood samples were collected from prematures, infants, and children (aged from 1day to 3years) admitted to the hospital of maternity and pediatrics in Najaf over a period of 3months from October to December 1996.

Blood Culture

In all cases blood was obtained by peripheral venepuncture after clearing the skin with 70% alcohol. At least 1 ml of blood was used for neonated blood culture [11].

The blood samples were, introduced directly into Brain Heart Infusion (BHI) broth bottles, the ratio 1:10 of blood to medium was used. Blood culture bottles were incubated at 35°C for seven days with shaking for the first 48hr. bottles were tested for growth of bacteria once on the day of receipt, twice on day 2, and once daily on day 3 through 7 [12].

Blood culture suspected of being positive were subcultured onto plates of MacConkey agar (Mast, U.K.), 5% human blood agar and chocolate agar (supplemented with 10% CO_2). All agar plates were incubated for 48hr. at 35°C.

Bacterial Isolates and Susceptibility Test

The recovered bacterial isolates were identified to the level of species by using conventional biochemical test [12-14].

The susceptibility of 117 *Klebsiella* ssp. To a number of antimicrobial agents was determined by using disk diffusion method and interpreted according to Barry and NCCLS documents [16-18].

The following antimicrobial agents were obtained (from Oxide, U.K.) as standard reference disks as known potency for laboratory use: Ampicillin (AMP.), Amoxicillin (Amox), Cephalexin (K), Cefotaxime (CTX), Ceftizoxime (CZX), Gentamycin (G), Chloramphenicol (C), Teracyline (T), Rifampin (R), and Trimethoprim-Sulfamethoxazole (SXT).

All these tests were performed on plates of Muller-Hinton agar (Oxoid, U.K.). A bacterial suspension matching to 0.5 MacFarland suspension was applied to the plates, which were dried in an incubator at 35°C for 15 minutes. Antimicrobial disks were placed on the agar with sterile forceps. The agar plates were incubated at 35°C for 18hr. the resulting zone of inhibition was measured in millimeters [16].

RESULTS

Of the 247 pediatric blood samples, 7 were found to have a mixed growth of bacterial species and *Staphylococcus epidermidis*. The latter was considered as a contaminant while the other bacterial species as the etiologic agent of bacteremia, thus all these seven blood cultures were considered as pure cultures for recovered bacterial strains.

Of 247 pediatric blood samples. The following bacterial isolates were recovered (Table-1).

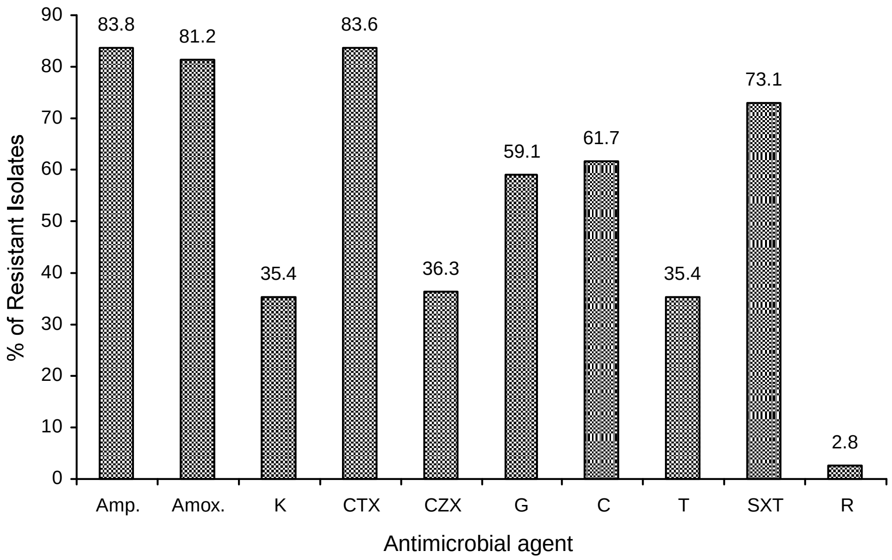
Of the 58 blood samples obtained from premature patients, 40 (68%) were positive to *Klebsiella* spp., 10(17%) to *E. coli*, and 8(13.6%) to other bacterial species (Table-1).

Antibiotic resistance of 117 *Klebsiella ssp*. Isolates were determined (Fig.1). *Klebsiella* spp. isolates were highly resistant to most of the antimicrobial agents studied. 59% to 83% of those isolates were resistant to pencillins (Amp, Amox), Cefotaxime (3rd generation cephalosporin), Gentamycin, Chloramphenicol and Trimethoprim-Sulfamethoxazole.

(Table-1): Bacterial isolates recovered from 247 pediatric blood samples.

Microorganism	No. of isolates (%)		
	Patients		
	premature	Infants & Children ≤ 3years	Total (%)
Gram-positive aerobes	7	32	39(15.7)
Staph. aureus	6	21	27(10.8)
β-hermolytic streptococci	-	4	4(1.6)
Str. Pyogenes	1	1	2(0.8)
Str. Pneumoniae	-	1	1(0.4)
Enterococcus faccalis	-	4	4(1.6)
Viridans Streptococci	-	1	1(0.4)
Gram-negative aerobes	51	157	208(84.2)
E. Coli	10	44	54(21.6)
Klebsiella spp.	40	77	117(46.8)
Enterobacter spp.	-	9	9(3.6)
Citrobacter spp.	1	-	1(0.4)
Proteus spp.	-	4	4(1.6)
Serratia marcescens	-	3	3(1.2)
Pseudomonas spp.*	-	13	13(5.2)
Acinetobacter calcoaceticus	-	2	2(0.8)
Alcaligens faecalis	-	5	5(2.0)

* five isolates of this genus were later identified as *Ps. aeruginosa.*



(Figure-1) Antibiotic resistant of 117 *Klebsiella spp.* Isolates recovered from 247 pediatric blood culture

Morderately 35-36% of *Klebsiela* spp. isolates were resistant to Cephalexin, Ceftizoxine, and Tetracycline, although these isolates highly sensitive to Rifampisin (97.2%). Among these isolates, a pattern of multiresistance was observed (Fig-1).

DISCUSSION

In this study the recovery of coagulase negative staphylococci (*S. epidermidis*) from blood culture was considered as false positive (contaminant). It is found that a rate of 2% to 3% of contamination in blood cultures may occur even under optimal circumstances during procuring and processing of blood [19].

Recent studies in the United States have indicated that bacteria such as *S. epidermidis* can be recovered from blood of healthy persons [2].

Clues to identify contaminants in blood cultures have been suggested [20]. In general, cutaneous flora such as coagulase negative staphyllococci isolated from one of several blood cultures should be presumed contaminant [21].

Although *Escherichia coli* is the most common etiologic agent of Gram-negative bacteremia [2, 8, 10], our results revealed that *Klebsiella* was the predominant in all pediatric blood cultures studied (Table-1).

Although contamination in blood cultures may occur under optimal conditions [19]. The probability of contamination in our blood culture with *Klebsiella ssp.* is very rare because it was found that organisms belonging to the family Enterobacteriaceae, *pseudomonas* species, *Strept. Pyogenes, Strept. Pneumoniae* and *S. aureus* are rarely contaminants [22].

In our study, the predominance of *Klebsiella* spp. in pediatric bacteremia is related to their developing emergence of multiresistance to several antimicrobial agents (Fig.-1).

The multiresistance pattern of *Klebsiella* spp. isolates may be an essential factor in nosocomial infections and might explain the emergence of some highly resistant *Klebsiella* strains in hospitalized patients [23].

Of the 247 blood cultures, 58(23.4%) were obtained from premature patients, this ratio of preterm delivery may considered as a predisposing factor for neonatal bacteremia.

Several previous studies demonstrate the major importance of preterm delivery as risk factor for invasive infections [4-7, 7-8].

Although *Salmonella* spp. are common in our country and considered (in other countries) as the most common causes of childhood septicaemia, which accounted for 15% of all, and 27% of community-acquired infections [10], *Salmonella* spp. was not recoded as etiologic agent of bacteremia in this study.

REFERENCES

1- Washington, J.A. and Iistrup, D.M. (1986). Blood cultures issues and controversies. Rev. Infect. Dis., 8: 792-802.

2- Wagner, G.E. (1990). Bacteremia and septicemia. In: kingsbury, D.T., and Wagner. G.E. (eds.) Microbiology. 2nd edition. John Wiely & Sons. Inc., USA. pp. 315-320.

3- Fredman, R.M., Ingram, D.L., Gross, I., Ehrenkranz, R.A., Warshaw, J.B., and Baltimore, R.S. (1981), A half century of neonatal sepsis at Yale, 1929 to 1978. Am. J. Dis. Child. 135: 140-144.

4- Bennet, R., Eriksson, M., and Zetterstrom, R. (1981) Increasing incidence of neonatal septicemia: causative organism and predisposing risk factors. Acta pediatr. Scand., 70: 207-210.

5- Karpuch, J., Goldberg, M., and Kohelet, D. (1983) Neonatal bacteremia. A 4-year prospective study. Isr. J. Med. Sci., 19: 963-966.

6- Bennet, R., Eriksson, M., and Zetterstrom, R. (1985) Changes in the incidence and spectrum of neonatel septicemia during a different year period. Acta pediatr. Scand., 78: 687-690.

7- Speer; C.P., Hauptmann, D., Stubbe, P., and Gahr, M. (1985): Neonatal septicaemia and meningitis in Gottingen, west Germany. Pediatric Infect. Dis., 4: 36-41.

8- Tessin, B. and Thiringer, K. (1990): Incidence and etiology of neonatal septicaemia and meningitis in western Sweden 1975-1986. Acta pediatr. Scand., 79: 1023-1030.

9- Ling, J., Chan, P.Y. and Ng, W.S. (1983) Susceptibility of blood isolates to various antibiotics in particular to cephalosporins. J. Antimicrob. Chemother., 11: 473-480.

10- French, G.L., Cheng, A.F.B., Duthie, R., and Cockram. C.S. (1990) Septicaemia in Hong Kong J. Antimicrob Chemother., 25: 115-125.

11- Szymczak, E.G., Barr, J.T., Durbin, W.A., and Glodmann, D.A. (1979) Evaluation of blood culture procedures in pediatric hospital. J. Clin. Microbiol., 9: 88-92.

12- Finegold, S.M. and Baron, E.J. (1990) Baily and Scott’s Diagnostic Microbiology. Eight ed., the C.V. Mosby Company. USA.

13- MacFaddin, J.E. (1980): Biochemical tests for identification of Medical Bacteria. 2nd ed., Williams & Wilkins, Baltimore, USA.

14- Cowan, S.T. (1985) Cowan and Steels Manual for Identification of Medical Bacteria. 2nd ed., Cambridge Univ. Press, U.K.

15- Collee, J.G. Fraser, A.G., Marmiom, B.P., and Simmon, A. (1996) Mackie & McCarteny Practical Medical Microbiology. 4th ed. Churchill Livingstone Inc., USA. pp. 978.

16- Barry, A.L. (1976), The Antimicrobic Susceptibility test: Principles and Practices pp. 180-195. Lea & Febiger, Philadelphia, USA.

17- NCCLS Subcommittee on antimicrobial susceptibility tests (1975) performance standard for antimicrobial disc susceptibility tests. 3rd ed., M2-A3, NCCLS, Villanova. PA.

18- National Committee for Clinical Laboratory Standards (1984). Performance standards for antimicrobial disk susceptibility tests. NCCLS, Villanova. PA.

19- Wilson, W., VanScoy, R. and Washington, J. (1975), Incidence of bacteremia in adults without infection. J. Clin. Microbiol., 2: 94-95.

20- Aronson, M.D. and Bor, D.H. (1987) Blood cultures. Ann. Intern. Culture. Arch. Intern. Med., 106: 246-253.

21- MacCregor, R. and Beaty, H. (1972), Evaluation of positive blood culture. Arch. Intern. Med., 130: 84-87.

22- Chandraskar, P.H. and Brown, W.J. (1994), Clinical issues of blood cultures. Arch. Intern. Med., 154: 841-849.

23- Livrelli, V., Dechamps, C., Martino, P.D., Darfenille-Michaud, A., Forestier. C., and Joly. B. (1996) Adhesive properties and antibiotic resistance of *Klebsiella*, *Enterbacter* and *Serratia* clinical isolates involved in noscomial infections. J. Clin. Microbiol., 34(8): 1963-1969.